UNITED STATES PATENT OFFICE.

WM. ANTHONY SHAW, OF NEW YORK, N. Y.

IMPROVEMENT IN THE ART OF MANUFACTURING AND UNITING ALLOYS OF METALS IN FORMING WATER-PIPES AND OTHER ARTICLES.

Specification forming part of Letters Patent No. **72,919**, dated December 31, 1867; antedated December 17, 1867.

To all whom it may concern:

Be it known that I, WILLIAM ANTHONY SHAW, of the city and county of New York and State of New York, have invented certain new and useful improvements in the art of manufacturing and uniting alloys of metals out of which various articles of commerce may be made, and which is especially applicable to the manufacture of water-pipe and sheet metal; and I do hereby declare the following to be such a full, clear, and exact description of my said invention as will enable those skilled in the arts to which it appertains to make and use the same.

For the purpose of showing the value and advantages of this invention, I will describe the manner of making it into a pipe, and incidentally describe to some extent the manner and advantages of making pipe by uniting two or more metals, as hitherto practiced.

On the 10th day of March, 1863, Letters Patent of the United States were granted to me for my invention of pressing a tin pipe or tube inside of a lead one. By that invention I gained two objects of prime importance: First, I avoided the poisonous effects of the lead upon the water; and, second, I increased the strength of the pipe or tube—that is to say, a pipe of a given size and weight, made in that way and of the united materials, is much stronger than a pipe of similar size and weight made of lead only, by which means I can make my pipe very much lighter than lead pipe, and at the same time maintain the strength due to lead pipe of corresponding internal diameter, and this difference of weight and strength is so much in favor of the tin-incased pipe that it can be afforded cheaper than lead pipe of corresponding size. These advantages flow from or grow out of the union of the tin with the lead. Now, I have discovered that I can in a degree obtain these advantages by using a different method of uniting the two metals or their alloys. The invention of this method is the subject-matter of this application, and the practice of it is as follows—that is to say, instead of making the pipe by passing one metal outside or inside of the other, I first make an alloy of the two metals. Take, for example, lead, and melt with it from five to ten per cent. of tin; or take lead, and melt with it from one to two per cent. of antimony; or take lead, and melt with it about one per cent. of antimony, and from one to five per cent. of tin. Of either of these alloys I make my pipe, in a hydraulic press constructed after the manner of the ordinary press used for making lead pipe; but when antimony is used as an element in the alloy, I obtain it as free from arsenic as possible, as the presence of the latter tends to make the compound hard and brittle.

Having made my pipe from some one of the alloys above mentioned, I coat it, inside or out, or on both sides, in the following manner—that is to say: I first prepare a solution of tin, or of tin melted with from five to ten per cent. of cadmium; or of that proportion of tin and cadmium with about five per cent. of bismuth; or of that proportion of tin, cadmium, and bismuth with five per cent. of lead melted with it; or of tin with about six per cent. of nickel and about ten per cent. of cadmium, the latter alloy giving greater hardness, less fusibility, and greater resistance to corrosive action than either of the others, and is, perhaps, the best alloy or solution for this purpose. This coating or solution, or either of them, is, of course, made by fusing the metals together, maintaining the temperature as low as may be consistent with their fusibility.

Having thus prepared my alloy, made my pipe, and prepared the solution as aforesaid, I coat the pipe by either throwing the solution through it, or by passing it through the solution. The pipe can be very well coated on the inside by throwing the solution through it; but when it is desirable to coat on the outside or on both sides, it is best to pass the pipe through the solution or bath; or the inside only of the pipe may be coated in this way, by first covering the outside of the pipe with a compound of lamp-black and glue, or some similar substance, to keep the solution or alloy from adhering to the external surface.

On the 18th of May, 1832, a patent was granted to one Eubank for his method of coating the inside of lead pipe with tin; but he made his pipe of pure lead, and his coating of tin only, which made the practice of his invention so difficult and imperfect that it had finally to be abandoned. His tin bath or solution would

get too hot, and melt off some of the lead, which would injure the purity of the coating; or the temperature of his bath would sink a little too low, which would make the coating clog or choke the pipe; or, if the pipe should oxidize a little in places, the coating would not adhere, but would run in lumps, and not only leave the lead bare in places, but would also choke the pipe; and, moreover, his process augmented the cost of the pipe without adding anything to its strength, for the coating of tin applied in this way, even when successfully done, will be so thin that no perceptible practical advantange can be derived from it in point of strength. So that Eubank's patent was really of no practical importance. Indeed, it was practically a failure, and had to be abandoned.

To make this process of any value, the metals must be so alloyed as to make the fusing-point of the alloy of which the pipe is made and the alloy of which the coating is made as wide apart as possible, so that the latter can be applied to the former without injury, and so as to increase the strength of the pipe, that its weight, and consequently its cost, may be reduced instead of being enhanced.

Eubank's method failed because the fusing points of his two metals were too near alike, and because he could not make his tin adhere well to his pipe for want of a proper preparation, and because his pipe was too expensive.

I overcome the difficulty he met with by first making two alloys, and afterward uniting them in a pipe—that is, by covering the one with the other, or by making the pipe of an alloy and covering it with tin simple, instead of making the pipe of pure lead and covering it with tin only. By these means I get a better, stronger, and cheaper pipe than can be made of lead or by Eubank's method of uniting lead and tin; and what is true of pipe is true of any other article made in this way and of these materials united as aforesaid.

In addition to the method of applying the coatings which I have described above, the application may be successfully made by the use of a double bath, the first one to contain solder, and the second pure tin or its alloy, the pipe to be passed through the bath, or the solution to be thrown into the pipe, as above stated; but to make the coating adhere well the pipe in all cases should be prepared by the application of a suitable flux made of rosin or sal-ammoniac, or a solution prepared as follows—that is to say: by dissolving one pound of zinc in muriatic acid, to which add twenty-two parts of sal-ammoniac, and evaporate to dryness; the result will be two and a quarter pounds of the double salt. To this add sufficient water to make a strong solution of the chloride of zinc and ammonia, and pass the pipe through the solution, or apply the solution in any convenient way. This alloy of which I make my pipe I propose to use to make sheet-lead of, also, and the alloy of which I make my pipe-coating I propose to use to coat sheet-lead with, intending to claim its union for either purpose, without confining myself to the exact proportions above given for making the alloys, or either of them.

Having now described the nature and extent of my invention, I claim and desire to secure by Letters Patent—

1. Covering the surface, either inside or out, or both inside and out, with an alloy of lead and antimony, or of lead and tin, or of lead, tin, and antimony, or their equivalents for this purpose, with pure tin, when said alloy is made in a pipe or other article of manufacture, substantially as described.

2. Covering the surface, either inside or out, or both inside and out, with an alloy of lead and antimony, or of lead and tin, or of lead, tin, and antimony, or their equivalent for this purpose, when made into a pipe or other article of manufacture, with an alloy of cadmium and tin, or of cadmium, tin, and bismuth, or of tin, lead, cadmium, and bismuth, or of tin and nickel, or of tin, nickel, and bismuth, or their equivalents for this purpose, substantially as described.

3. Covering an alloy of lead with an alloy of tin, when made in a pipe or other article of manufacture, by first making the lead-alloyed pipe or article and then applying the tin alloy thereto in a state of fluidity.

WILLIAM ANTHONY SHAW.

Witnesses:

AMOS BROADNAX,

EDWARD P. FLINT.